(12) UK Patent Application (19) GB (11) 2 344 796 (13) A

(43) Date of A Publication 21.06.2000

(21) Application No 9827948.2

(22) Date of Filing 19.12.1998

(71) Applicant(s)
Rover Group Limited
(Incorporated in the United Kingdom)
International Headquarters,
Warwick Technology Park, WARWICK, CV34 6RG,
United Kingdom

(72) Inventor(s)
William Richard Hutchins

(74) Agent and/or Address for Service
Alan S Wilson
Rover Group Limited, Gaydon Test Centre,
Banbury Road, Lighthorne, Warwick, CV35 0RG,
United Kingdom

(51) INT CL^7
B60G 9/04

(52) UK CL (Edition R)
B7D DSCC

(56) Documents Cited
GB 0434330 A

(58) Field of Search
UK CL (Edition Q) **B7D DSCA DSCC**
INT CL^6 **B60G 9/00 9/04 11/32 11/34 11/36 11/38 11/40 11/42 11/46 11/48 11/50 11/52 11/54 11/56 11/58 11/60 11/62 11/64**
Online: WPI, EPODOC, JAPIO

(54) Abstract Title
Vehicle suspensions

(57) A vehicle suspension comprises a beam axle 10 on which the body 12 is supported by springs 14. The wheels 16 are connected to the ends of the axle 10 by pivoting arms 18, 20 and spring struts 22 which allow small amplitude movements of the wheels relative to the beam axle 10, whilst large amplitude wheel movements are accommodated by movement of the beam axle relative to the body 12.

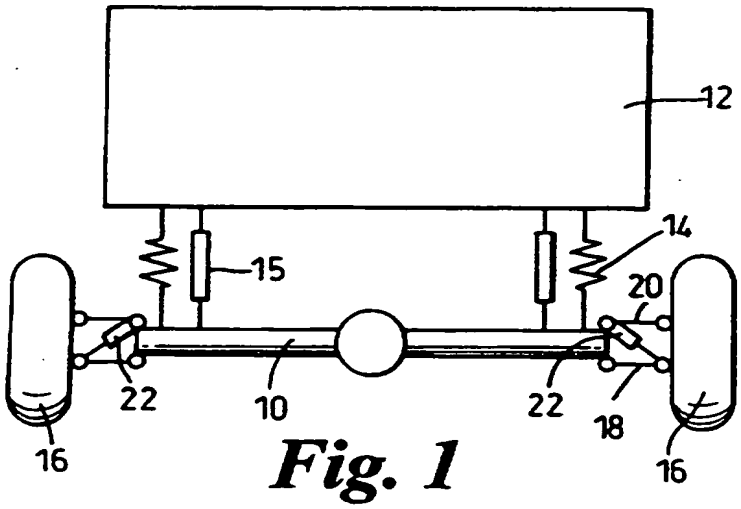


Fig. 1

GB 2 344 796 A

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

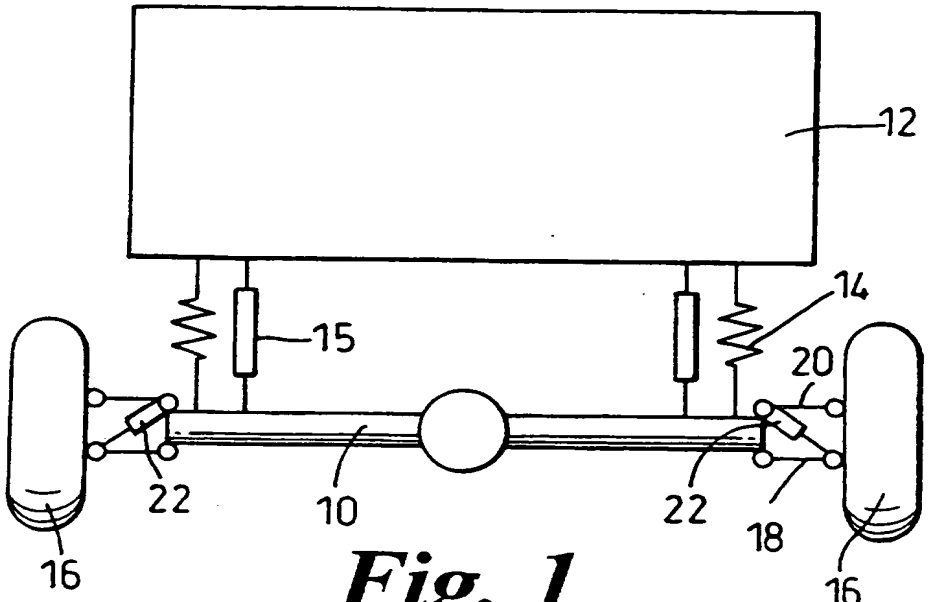


Fig. 1

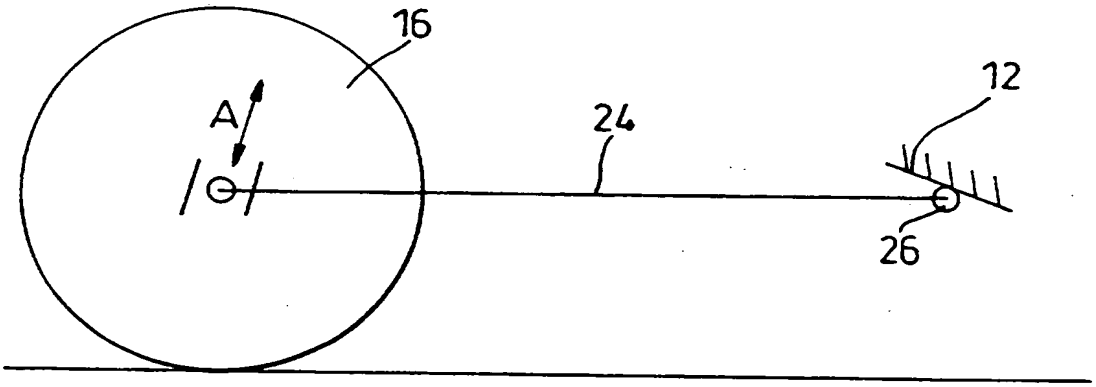


Fig. 2

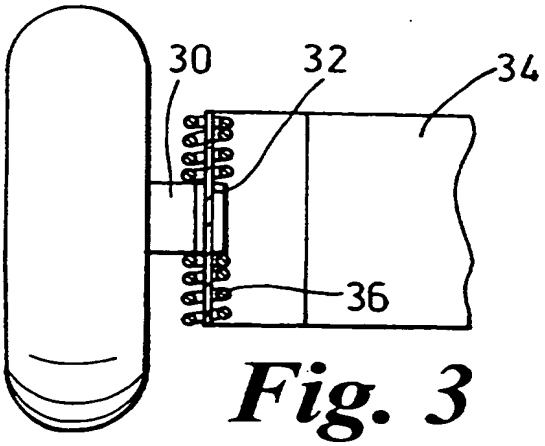


Fig. 3

Vehicle Suspensions

The present invention relates to vehicle suspensions.

Conventional suspensions are generally of the beam axle type, in which two wheels are mounted on opposite ends of a rigid beam onto which the vehicle body is mounted, or the independent type, in which each of the wheels is independently connected to the body by means of suspension links, such as in a wishbone type suspension.

For on-road driving and fast driving over rough surfaces independent suspensions have the advantage that they are better at absorbing high frequency wheel movements. However in off-road situations where high levels of wheel travel are required beam axles have the advantage that they can more easily accommodate high levels of roll and cross articulation without loss of track control and camber control.

The present invention provides a suspension for connecting two wheels to a vehicle body, the suspension comprising a beam axle, first resilient support means for mounting the vehicle body on the axle, wheel support links pivotably connected to the ends of the beam axle for connecting the wheels to the beam axle, and second resilient support means controlling pivoting of said links relative to the beam axle thereby to control movement of the wheels relative to the axle.

Preferably the second resilient support means comprises a spring strut acting between the outboard end of at least one of the links on each end of the beam axle, and the beam axle.

Preferably the suspension includes damping means arranged to damp movement of the wheels relative to the beam axle.

Preferably the links are arranged to control the movement of the wheels relative to the beam axle so that it has at least a component in the longitudinal direction of the vehicle thereby providing fore-aft compliance.

Preferably the beam axle is connected to the body by means of a rigid suspension link extending in the longitudinal direction of the vehicle which prevents significant fore-aft movement of the beam axle relative to the body.

Preferred embodiments of the present invention will now be described by way of example only with reference to the accompanying drawings in which:

Figure 1 is a schematic front view of a suspension according to a first embodiment of the invention,

Figure 2 is a schematic side view of the suspension of Figure 1, and

Figure 3 is a section through part of a suspension according to a second embodiment of the invention.

A vehicle front suspension for a four-wheel drive vehicle comprises a rigid beam axle 10 on which the vehicle body 12 is resiliently supported in a conventional manner by springs 14. Dampers 15 are also provided acting between the axle 10 and the body 12 to damp relative movement between the two. At each end of the beam axle one of the front wheels 16 is supported on a pair of rigid arms 18, 20 each pivotably mounted at the inboard end on the beam axle 10 and at the outboard end on the wheel hub carrier. The axes of the pivots are angled to the horizontal so that as the wheels move upwards they also move backwards, and as they move downwards they also move forwards. Their direction of travel is shown by the arrow A in Figure 2. A spring strut 22 is connected between the outboard end of the lower arm 18 and the inboard end of the upper arm 20 where it is

connected to the beam axle. These struts 22 therefore resist upward movement of the wheels relative to the beam axle. The struts 22 also include integral dampers which are arranged to provide a lesser degree of damping than those 15 between the axle and body. This is so that higher frequency wheel movements can be absorbed by movement of the upper and lower arms 18, 20 and will not be transmitted into the axle, whereas higher amplitude lower frequency wheel movements, which will induce movement of the axle 10 relative to the body 12, will be damped to a greater degree by the dampers 15.

A shown in Figure 2 each end of the beam axle is also connected to the body by a rigid horizontal link 24 which is connected to a pivot 26 on the body 12 a long way from the beam axle 10 so that it acts as an anti-squat / anti dive link. These links 24 are their connections to the body 12 and axle 10 are rigid and they therefore do not provide any fore-aft compliance for the beam axle 10.

When the vehicle is travelling at relatively high speeds over a rough surface the wheels 16 can move over short distances relative to the beam axle in the direction of the arrow A, the arms 18, 20 and spring struts 22 absorbing small amplitude high frequency vibrations. The beam axle 10 also serves to isolate the body 12 from these vibrations as it has significant mass and acts as a barrier to their transmission into the body 12. Furthermore fore-aft compliance is also provided for the wheels because of the angle of their direction of travel relative to the beam axle 10 which allows them to move rearwards as well as upwards when they impact on small obstacles. In off-road situations where high wheels movement is required, this is provided by movement of the beam axle 10 relative to the body 12.

Referring to Figure 3, in a second embodiment of the invention the wheel hub carriers 30 are mounted on vertical pillars 32 on the ends of the beam axle 34, and

can slide up and down the pillars 32. Their movement along the pillars is controlled by springs 36. The pillars 32 can be angled to the vertical so that the wheels move in the direction of the arrow A of Figure 2 so as to provide fore-aft compliance.

CLAIMS

1. A suspension for connecting two wheels to a vehicle body, the suspension comprising a beam axle, first resilient support means for mounting the vehicle body on the axle, wheel support means connecting the wheels to the ends of the beam axle so as to movable vertically relative to the beam axle, and second resilient support means controlling movement of the wheels relative to the beam axle.

2. A suspension according to claim 1 wherein the wheel support means includes at least one link pivotably connected to the beam axle.

3. A suspension according to claim 2 wherein the second resilient support means comprises a spring strut acting between the outboard end of the link on each end of the beam axle, and the beam axle.

4. A suspension according to claim 1 wherein the wheel support means comprises two parts slidable relative to each other to allow movement of the wheels relative to the beam axle.

5. A suspension according to any foregoing claim including damping means arranged to damp movement of the wheels relative to the beam axle.

6. A suspension according to claim 5 wherein the damping means is also arranged to damp movement of the beam axle relative to the body, to a degree which is greater than that of the damping of the wheels relative to the beam axle.

7. A suspension according to any foregoing claim wherein the links are arranged to control the movement of the wheels relative to the beam axle so that it has

at least a component in the longitudinal direction of the vehicle thereby providing fore-aft compliance.

8. A suspension according to claim 7 wherein the beam axle is connected to the body by means of a rigid suspension link extending in the longitudinal direction of the vehicle which prevents significant fore-aft movement of the beam axle relative to the body.

9. A vehicle suspension substantially as hereinbefore described with reference to the accompanying drawings.

The Patent Office

7

INVESTOR IN PEOPLE

Application No:	GB 9827948.2	**Examiner:**	Peter Macey
Claims searched:	1 - 9	**Date of search:**	20 April 1999

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): B7D (DSCA, DSCC)

Int Cl (Ed.6): B60G 9/00, 9/04, 11/32, 11/34, 11/36, 11/38, 11/40, 11/42, 11/44, 11/46, 11/48, 11/50, 11/52, 11/54, 11/56, 11/58, 11/60, 11/62, 11/64

Other: Online: WPI, EPODOC, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB 434330 (Daimler-Benz) See especially figure 5	1, 2

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

EUROPEAN PATENT OFFICE

Patent Abstracts of Japan

PUBLICATION NUMBER : 11078457
PUBLICATION DATE : 23-03-99

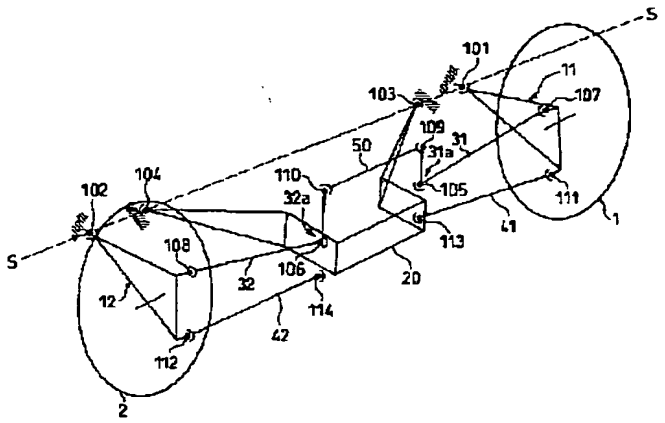
APPLICATION DATE : 01-09-97
APPLICATION NUMBER : 09235809

APPLICANT : TOYOTA MOTOR CORP;

INVENTOR : OIKAWA AYA;

INT.CL. : B60G 9/04 B60G 21/05

TITLE : SUSPENSION DEVICE FOR VEHICLE



ABSTRACT : PROBLEM TO BE SOLVED: To sufficiently suppress wheel alignment change including toe angle change, camber angle change and scuff change by connecting one-side connecting parts of first link members oscillatingly supported to a horizontal member, to carriers, and connecting the other-side connecting parts of the first link members to each other by a second link member.

SOLUTION: A suspension device such as a rear suspension for an FF type vehicle is composed of wheel carriers 11, 12, a suspension member 20, upper links 31, 32, lower links 41, 42 and a connecting link 50. One ends of the wheel carriers 11, 12 are supported to a body through joints 101, 102. One end of each of the upper links 31, 32 and lower links 41, 42 is connected to the suspension member 20, and both ends of the suspension member 20 are supported to the body through joints 103, 104. The other connecting parts of the upper links 31, 32 are connected to each other by the connecting link 50 provided with joints 109, 110 at both end parts.